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ABSTRACT

This booklet provides information for teachers about the value of appropriate animal use in the classroom and some suggestions for assuring the proper care and use of animals in education. Discussion includes: (1) the importance of animals in education; (2) contributions of animals in classroom learning; (3) contributions of animals to science history and medical progress; and (4) animal welfare versus "animal rights" in the classroom. Information sources where teachers can obtain suggestions for hands-on activities involving animals in the classroom, a list containing major documents available from public and private organizations outlining policies, information, and resources regarding the care and use of animals in research and education, and a bibliography of books, brochures, and magazine articles that provide additional information are included. Milestones in biomedical research that depended on animal studies from pre-1990 to the present are provided. (KR)

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Animals and Science

Photo by David Hathcox

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What you should know.
What you can do.

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DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Alcohol, Drug Abuse, and Mental Health Administration

SE 052 812

PREFACE

For over a century, much of the Federal Government's medical research has been conducted through the Public Health Service (PHS). PHS-funded research has found cures or treatments for diseases that now have been virtually conquered, such as smallpox or yellow fever. Today, support for progress against diseases that still threaten us—cancer, heart disease, birth defects, alcoholism and drug addiction, and mental illnesses such as schizophrenia—is provided through two major PHS agencies, the Alcohol, Drug Abuse, and Mental Health Administration (ADAMHA) and the National Institutes of Health (NIH). Together, these agencies fund most of the federally supported medical research in the country.

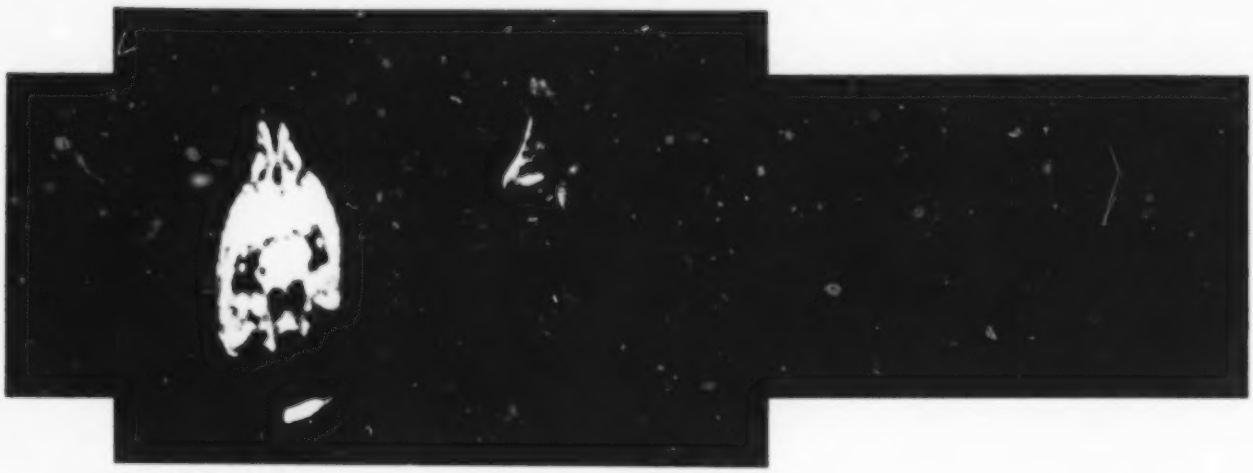


Photo by Burt Glinn

Following the launch of Sputnik in 1957, numerous curriculum studies and reform projects were initiated in the United States in a massive effort to improve science education. Within ten years, new curriculum guidelines and precollege education programs—emphasizing hands-on experiences for instruction in all sciences—were developed and implemented in over 80 percent of U.S. schools.

Such enhancements in general biology education resulted in a greater use of animals in the classroom, actively involving students in direct learning/discovery processes. Many of these activities were imaginative and fostered student interest in science. A generation of today's medical doctors and researchers, whose career interests were often fueled in grade and high schools, were the first beneficiaries of this hands-on science instruction. These scientists have made American biomedical research the finest and most advanced in the world. Today's healthier U.S. children—recipients of improved medical care from these new doctors and medical scientists—represent a second generation of beneficiaries.

As a teacher, you know that your students are usually vaccinated against common childhood diseases, such as measles and polio. You yourself may be required to undergo routine tuberculosis tests, immunizations or other medical procedures. Many of your students have also undergone such minor surgical procedures as stitches; others have had broken bones set or operations for appendicitis. Some may even have been treated for such life-threatening conditions as leukemia or other cancers. Knowingly or not, you and your students have benefited directly from the use of laboratory animals in medical research.

Research using animals allows scientists to discover how diseases operate, how they gain a foothold in the body, how they affect an entire living system and, most importantly, how they may be cured or treated. Animals serve as biological stand-ins for human beings in biomedical studies. Virtually all medical researchers agree that use of animals in such work is a matter of scientific necessity.

Today, however, animal research—this basic tool of medical progress—is under attack by animal rights activists, whose declared aim is to limit severely, or even stop, the use of animals in medical and scientific research.

Just as the appropriate use of animals is important in medical research, so is it important in science education, where students learn the basic principles and disciplines that govern all the sciences. And today, the use of animals in education is also increasingly being questioned by animal rights activists, posing a challenge to the quality of instruction in the life sciences in particular. This booklet provides information for teachers about the value of appropriate animal use in the classroom and some suggestions for assuring the proper care and use of animals in education.

WHAT YOU SHOULD KNOW

The Importance of Animals in Education

Animals in the classroom can provide important learning experiences in both science and ethics for elementary, middle and high school students. In properly supervised educational settings, activities and experiments with animals can introduce students to basic concepts of biology, principles of scientific inquiry, and the value of and need for humane care and use of animals.

Using animals in the classroom to achieve such educational objectives can raise important issues for teachers and students to explore: What contributions have animals made in scientific inquiry, now and in the past? What is the role of animals in education? In science and medical research? Are there "alternatives" to the use of animals in research and education? If so, what are their advantages and drawbacks?

Contributions of Animals in Classroom Learning

A good life sciences education will help all children learn about the basic biological and physiological behavior of both animals and man. In formal school settings, animals can be humanely used in a variety of ways:

- classroom visitors/residents;
- field trips;
- science fair projects;
- observations, collections, dissections and demonstrations.

When careful consideration is given to activities that foster appropriate educational objectives as well as practices of good stewardship in the use of animals, a rewarding "hands-on, minds-on" experience for students is the likely result.

In many instances, non-animal tools such as computers, physical models (plastic, clay, etc.), and videotapes can serve as significant educational supplements to the use of animals in teaching certain concepts and facts in the life sciences. However, activities that involve the direct use of animals—including dissection and demonstrations—remain an invaluable tool for teaching the processes as well as the content of scientific disciplines such as anatomy and physiology. Such activities allow students to experience what it is to be a scientist: to observe, to think, to question, to test.

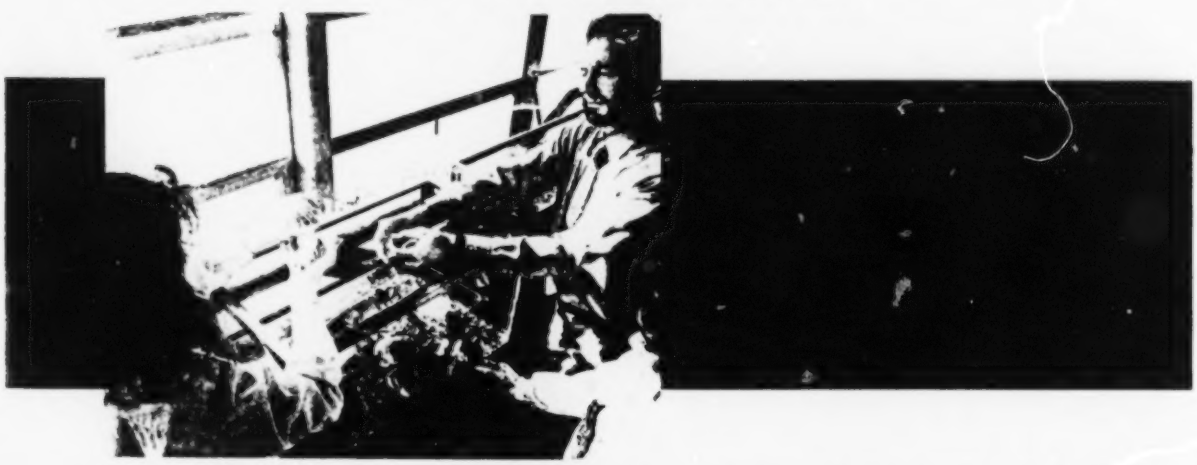


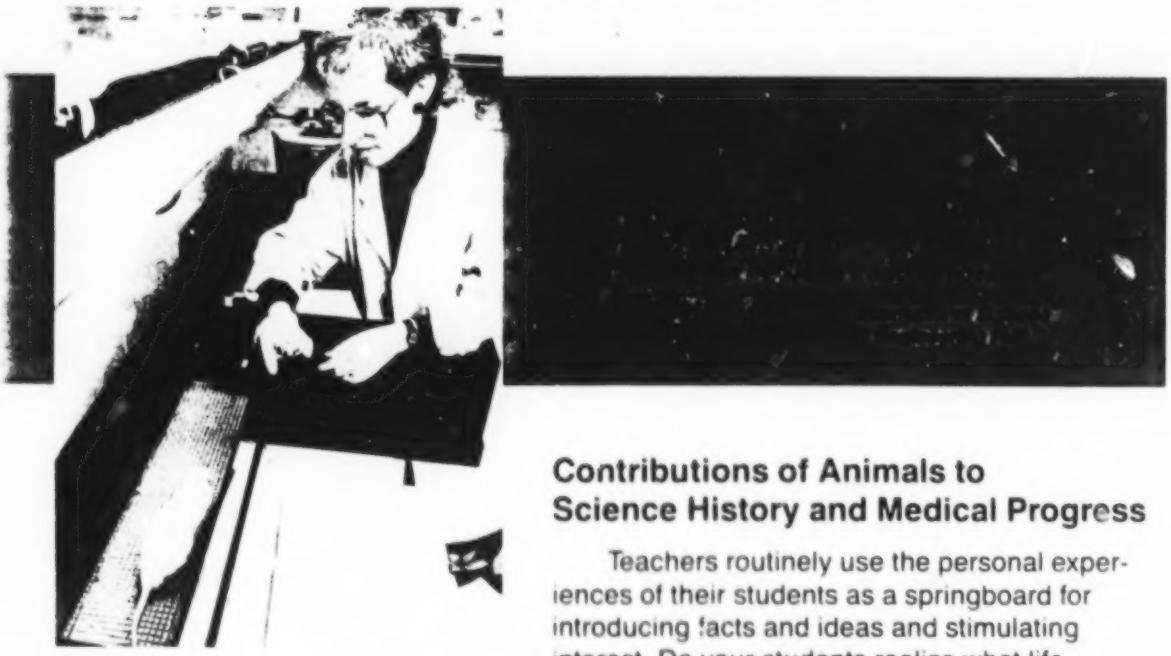
Photo by Robert Dunwoody

More complex, longer-term projects are often designed to introduce students to scientific methods, such as good record-keeping and careful stating of fact as a pre-condition for forming hypotheses. Examples include such typical experiments as

measuring the growth of rodents under various environmental conditions, cutting planaria to study regeneration, and observing the developmental stages of chick embryos.

Such learning experiences provide a realistic introduction to research. They incorporate, in simplified forms, direct experience with laboratory theory and practice. And hands-on experiences provide students with a foundation for appreciating the discipline of science, whether or not they become directly involved with laboratory animals later in their careers. Finally, such opportunities help tomorrow's scientists to be better prepared to design and conduct meaningful and humane research using animals.

Total elimination of classroom activities that use animals can reduce the quality of instruction in the life sciences to mere memorization and recitation of terms and isolated facts.



Contributions of Animals to Science History and Medical Progress

Teachers routinely use the personal experiences of their students as a springboard for introducing facts and ideas and stimulating interest. Do your students realize what life-threatening diseases they no longer have to confront: polio, diphtheria, cholera? (See the chart of major medical advances on back cover.) What diseases may still affect them, their families, friends, people they read about? Heart disease? Cancers? Alzheimer's? Drug and alcohol addiction? Severe depression? Birth defects such as cystic fibrosis? How will we combat new life-threatening diseases, such as AIDS, when they arise?

Helping Students Understand Basic Scientific Research Principles

To make new discoveries in science and medicine, data about biological, physical, and chemical processes must be collected and analyzed. In many cases, data obtained directly from human beings are the most desirable. But often such data

are difficult or even unethical to gather. For example, scientists cannot infect pregnant women with diseases in order to study effects of different medicines in their unborn babies. In this and other instances, researchers must rely on laboratory animals as models, or biological substitutes, for humans.

Adjuncts to the use of animals—such as cell and tissue cultures and computer models—are widely employed by today's scientists in their constant search for better methods and tools. Such non-animal adjuncts are sometimes referred to as "alternatives." This use of the word "alternative" can be misleading, however, when it is meant to suggest that non-animal methods are usually or often as effective as, or preferable to, the use of animal models. In some cases, a specific adjunct is discovered that can substitute for animal use. An example is the replacement of live rabbits with an immune system test to detect pregnancy in women. In general, however, the use of adjuncts at many stages of medical research is limited by their inability to simulate the full complexity of biological interactions that occur in living human/animal systems.

Some of the same adjuncts used in medical research—such as computers, videotapes, cell and tissue cultures—may also serve as helpful tools to supplement the use of animals in classroom instruction. However, eliminating animals in the classroom altogether can severely restrict the nature and quality of instruction in the life sciences. Many students will never receive any formal life sciences education after leaving high school. Their exposure to animals in the classroom may provide their only direct experience with hands-on scientific training—the basic foundation that can help them comprehend developments that will occur in science and medicine during their adult lives.

Some education publications cite the "3Rs" as a principle that life science teachers should incorporate into their classroom instruction and activities. This principle seeks to *reduce* the number of animals used, *refine* procedures using animals (particularly to prevent or minimize pain), and *replace* animal use with other techniques.

The principle originally derives from scientists' constant quest to find better ways to pursue methods of research that are more accurate, reliable and efficient. The application of the 3Rs in the classroom can assist teachers in communicating life science lessons when classroom limitations (time constraints, availability, teacher training) make the direct use of animals impossible or inadvisable.

Increasingly, however, the 3Rs are being promoted by some animal rights activists as a means of *eliminating* classroom use of animals altogether, rather than as a way of assuring their proper, effective use. To avoid this negative

Appropriate

Identify what animal is appropriate for the specific lesson you have planned.

Beneficial

Ensure that hands-on experiences with animals will benefit the class. Animal use should illustrate and enhance a planned lesson.

Caring

Take time to discuss the proper care of animals prior to using any animals in the classroom.

interpretation, it may be helpful for teachers to consider a more positive set of principles to guide the classroom use of animals. Such uses should incorporate the ABCs—Appropriate, Beneficial, and Caring use of animals in education.

Animal Welfare vs. "Animal Rights" in the Classroom

Concern about issues associated with the use of animals in education and research may lead to classroom discussions, debates, and disputes. Teachers can help students to understand the issues involved and the implications of particular decisions. The success of today's educators in providing students with this basic information and experience in analyzing issues may have a direct impact on the level of scientific literacy among tomorrow's general public. And, in turn, a public literate about scientific issues will be better able to decide on the soundness of future public policy decisions affecting continued scientific and medical progress in the United States.

In clarifying issues involving animal use, it is useful to recognize that there is a range of positions in today's society, from the beliefs held by the traditional humane societies dedicated to animal welfare to the concepts of animal rights activists. At one end of the range, animal welfare is often generally defined as a concern for the proper care, treatment, and shelter of animals and for their appropriate use. At the other end, animal rights activists believe that animals have intrinsic rights that are equal to human rights. Therefore, some animal rights groups argue that animals should not be used for *any* human purpose—including food, clothing, education, medical and scientific research, or even as family pets. Animal rights proponents sometimes try to appear to be interested only in animal welfare.

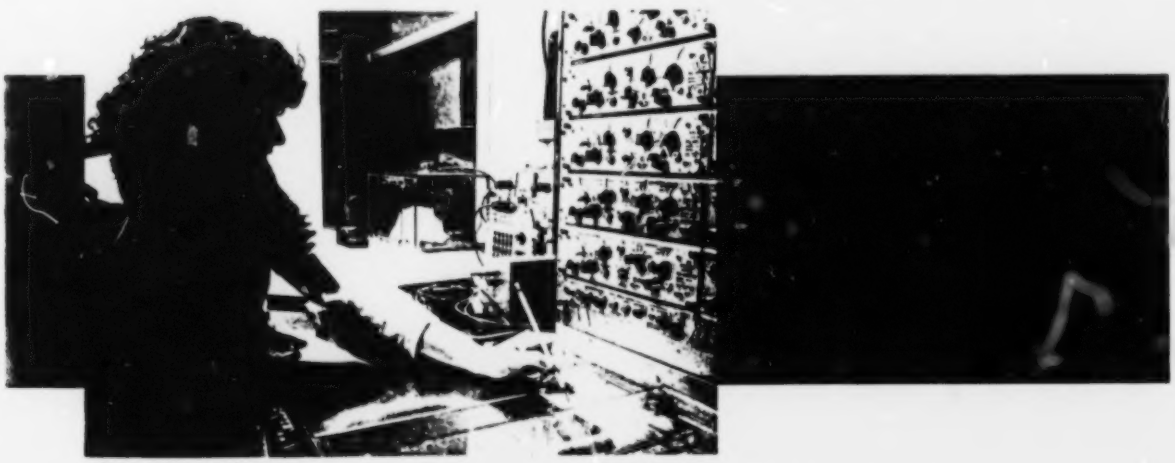


Photo by David Hathcox

Guidelines for Animal Use in the Classroom

Numerous Federal and State laws, regulations, and guidelines govern the use of animals in research. For scientific

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as well as humanitarian reasons, scientists must prevent or minimize pain, suffering, and undue stress; they must ensure that living conditions for laboratory animals are humane and appropriate. And in the classroom, just as in the research laboratory, proper care and use of animals must be a primary consideration.

The following principles are a few of the many recommendations that have been developed by scientists, educators, and animal care experts to guide the use of animals in precollege education. (See the reference materials on p. 10 for a more complete listing of rules and recommendations published by a variety of professional organizations.)

- All student research activities using animals should be supervised by individuals knowledgeable about appropriate animal care and use.
- Appropriate daily care of animals, including nutrition, housing, and safety, must be provided.
- Veterinary care must be provided as needed.
- In projects using live animals, appropriate provisions for pain prevention must be assured.
- Proper procurement and disposition of animals must be planned prior to initiating any activity.
- At lower grade levels, preference should be given to observational studies when using live vertebrate animals.
- Teachers and students should be aware of, and take precautions against, diseases (zoonoses) transmitted by animals to humans.

ZOONOSES

are animal diseases that can be transmitted to humans. Some of the more severe diseases transmissible to humans include rabies and Rocky Mountain Spotted Fever. Classroom problems with animal diseases are rare and can be prevented by good classroom practices and careful hygiene, including thorough hand-washing.

WHAT YOU CAN DO

Become Informed

Subscribe to a few science journals or periodicals. Keeping abreast of major developments in life sciences

research allows educators to provide students with accurate information about current scientific and medical investigations and to answer student questions regarding the use of animals in such research.

- Review carefully materials prepared by animal welfare/rights groups that deal with issues involving the use of animals in science and education. Many humane societies and animal welfare organizations produce sound and useful information about the care of pets and the prevention of animal abuse; however, many publications advocating animal rights contain information that is often misleading, scientifically inaccurate or even false. You may wish to ask a local scientist to review and advise you regarding the materials you would like to use in the classroom.
- Invite local researchers and scientists to your classroom to talk with your students. Many medical schools, research and development laboratories, hospitals, and veterinary practices can help identify scientists, doctors, and technicians willing to volunteer their knowledge and time.
- Tour a local research facility. Observation of modern laboratory facilities can give your students an opportunity to learn about humane care of laboratory animals.

Become Involved

- Participate in science education workshops, seminars, and panel discussions concerning animal care and use issues.
- Volunteer to form or serve on a school or district animal care and use committee.
- Contribute articles and letters to professional periodicals, sharing your experiences and opinions regarding the appropriate use and the benefits of animals in education.
- Strengthen your own science background by taking courses that will update your knowledge and skills in life science disciplines.
- Enroll in teacher in-service training or in summer programs dealing with animal care and use in education at local universities. If such courses are not presently offered, request them together with colleagues who also wish to improve their own skill and knowledge levels.
- Encourage students to participate in local and national science fairs.
- Publicly support the humane, appropriate use of animals in research and education.

Hands-on Activities. Below are some information sources where teachers can obtain suggestions for hands-on activities involving animals in the classroom:

- **Animals in Action** (1986), Great Explorations in Math and Science (GEMS), Lawrence Hall of Science, University of California, Berkeley, CA 94720.
- **Animals In The Classroom**, teachers' workshop on the humane care and use of vertebrates in education and student research, The Ohio State University, 328 Bevis Hall, 1080 Carmack Road, Columbus, OH 43210-1002.
- **Zoological Education Departments** – for information near you, write to: American Association of Zoological Parks and Aquariums, Ogle Bay Park, Wheeling, WV 26003-1698.
- **Local Science Museums** – for addresses near you, write to: Association of Science and Technology Centers, 1413 K Street, N.W., Washington, D.C. 20005-3405.

Care and Use Guidelines. This list contains major documents available from public and private organizations outlining policies, information, and resources regarding the care and use of animals in research and education:

- **Animal Welfare Act** of 1966, as amended. Copies can be obtained from the U.S. Department of Agriculture, APHIS-VS, Federal Building, 6505 Belcrest Road, Hyattsville, MD 20782, or consult your local library.
- **Public Health Service Guide for the Care and Use of Laboratory Animals** and **PHS Principles for the Care and Use of Animals in Testing, Research, and Education**, Office for Protection from Research Risks (OPRR), National Institutes of Health, 9000 Rockville Pike, Building 31, Room 5B59, Bethesda, MD 20892.
- **Principles and Guidelines for the Use of Animals in Precollege Education**, Institute of Laboratory Animal Resources (ILAR), National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.
- **Code of Practice on the Use of Animals in Schools**, National Science Teachers Association, 1742 Connecticut Avenue, N.W. Washington, D.C. 20009.
- **Guide to the Use of Live Animals in the Classroom**, National Association of Biology Teachers, 11250 Roger Bacon Drive, Reston, VA 22090.
- International Science & Engineering Fair, **Rules For Research Involving Vertebrate Animals**, Science Services, Inc., 1719 N Street, N.W., Washington, D.C. 20036.

Milestones in Biomedical Research That Depended on Animal Studies

SPECIES STUDIED	MEDICAL ADVANCE
PRE 1900	
dogs, rabbits	**Treatment for rabies** – deadly disease marked by convulsions and death; afflicts wild and domestic animals; can be transmitted to humans
sheep	**Treatment for anthrax** – disease marked by rise in body temperature followed by depression, spasms, respiratory or cardiac distress, convulsions, and death. Devastating epidemics were recorded up until the 19th century
chickens	**Treatment for beriberi** – a vitamin B1 deficiency that causes facial and nerve impairment
cows	**Treatment for smallpox** – one of the world's most dreaded plagues; estimated to have caused 2,000,000 deaths as recently as 1967; declared eradicated in 1977
1900's	
rhesus monkeys, dogs	**Treatment for pellagra** – a niacin deficiency marked by skin lesions, intestinal and nervous system disturbances
dogs	**Treatment for rickets** – a vitamin D deficiency causing defective bone growth in infants and children
dogs, rabbits	**Development of cardiac catheterization techniques** – a procedure which allows doctors to insert a flexible tube into an artery or vein to the heart; used for injecting drugs directly into the heart to measure blood flow and pressure; diagnose and treat congenital heart disease and narrowed passages
1920's	
many species	**Discovery of thyroxin** – one of two major hormones secreted by the thyroid which enables the body to use oxygen
dogs	**Discovery of insulin** – to control diabetes, a chronic disease of the pancreas marked by the inability to utilize carbohydrates; excess sugar in the blood and urine; excessive thirst, hunger and urination; weakness and emaciation; can cause blindness and death

SPECIES STUDIED	MEDICAL ADVANCE
1930's	
many species	**Prevention of tetanus** – also called lockjaw; an acute infectious disease of humans and other animals characterized by painful muscle spasms and convulsions
cats	**Development of anticoagulants** drugs that inhibit the action of blood clotting factors that, in excess, can cause clots, phlebitis, embolisms and lead to death
dogs	**Development of modern anesthesia** – allowing artificially induced unconsciousness or local or spinal insensibility to pain
1940's	
rabbits, monkeys	**Treatment of rheumatoid arthritis** a disease in which the connective tissues of the body become inflamed; cause still unknown, but medications relieve pain and control inflammation
many species	**Therapeutic use of antibiotics** development of penicillin and other broad-spectrum antibiotics revolutionized the treatment of bacterial infection in humans and other animals
chickens, guinea pigs	**Therapeutic use of streptomycin** – the first antibiotic effective in treating tuberculosis, pneumonia, spinal meningitis and typhoid fever
rhesus monkeys	**Discovery of the Rh factor** – the ability to detect the Rh antigen in red blood cells marked a breakthrough in the immunology of pregnancy
horses	**Prevention of diphtheria** – an acute contagious disease marked by formation of membranes in the throat and other air passages, causing difficulty in breathing, high fever, weakness and often death
guinea pigs, rabbits	**Treatment for whooping cough** – also called pertussis, among the most acute infections of children; a highly communicable respiratory disease characterized by short dry coughs; serious complications include convulsions and brain damage

SPECIES STUDIED	MEDICAL ADVANCE
1950's	
rabbits, monkeys, rodents	**Prevention of poliomyelitis** – also called polio or infantile paralysis, marked by symptoms ranging from mild infection to extensive paralysis. In 1950, 33,344 cases were reported in the U.S. alone; today there are virtually none
dogs	**Development of open heart surgery and cardiac pacemaker** – revolutionized treatment for people suffering from severe heart disease
rats, mice	**Discovery of DNA** – determines individual hereditary characteristics
cats, rabbit, monkeys	**Discovery of chlorpromazine and other tranquilizers** – chemical compounds used to reduce hyperactivity, anxiety and tension
monkeys, rabbits, rodents	**Development of cancer chemotherapy** – can bring about remission of different cancers, either short term or permanently
1960's	
monkeys	**Prevention of rubella** – also called German Measles, an epidemic viral disease marked by low fever, rash, enlarged lymph glands; can cause severe fetal defects in pregnant women
cats, guinea pigs	**Development of lithium** – for prevention of manic-depressive illness and recurrent depression
rats, mice	**Development of antipsychotic and antidepressant drugs** – for treatment of various mental illnesses
1970's	
rabbits, rats	**Discovery of cimetidine** widely prescribed to treat gastric ulcers
many species	**Prevention of measles** – an acute contagious viral disease, once common in childhood, marked by fever, skin eruptions; can cause death
monkeys, armadillos	**Treatment for leprosy** – a chronic infectious disease marked by severe paralysis, ulceration, nutritional disturbances, gangrene and mutilation
dogs	**Advances in cardiology** – including measurement of coronary blood flow, myocardial preservation techniques and heart transplant and coronary artery bypass techniques

SPECIES STUDIED	MEDICAL ADVANCE
1980's	
mice, rabbits	**Development of monoclonal antibodies for treating diseases** – marked a milestone in the use of antibodies as diagnostic or therapeutic tools to target specific disease cells
dogs, sheep, cows, pigs	**Organ transplant techniques** – surgical and medical advances such as anti-rejection drugs to enable heart, liver, lung and other transplants to succeed
primates	**Research on communicative abilities** – led to the development of techniques for teaching language to children with mental retardation
monkeys	**Discovery of genetic factors** leading to treatments for predispositions which contribute to the development of behavior problems such as chronic anxieties
primates	**AIDS, Alzheimer's Disease** – research is currently being conducted to understand the role of viruses in degenerative disorders
mice, rats	**Development of gene therapy/replacement** – wide potential for future treatments for genetic disorders such as cystic fibrosis

Today, approximately 90 percent of all research animals are rats, mice, and other rodents; less than 1 percent are monkeys and other non-human primates. Researchers choose the species best suited to investigating a specific disease or condition; different animal models may be used at different stages of research.

Bibliography for Educators and Students. This list suggests books, brochures, and magazine articles providing some additional information about the animal rights movement and the use of animals in research:

- Foundation for Biomedical Research. **Caring for Laboratory Animals**. Washington, D.C., Foundation for Biomedical Research, 1986 (98-page booklet).
- Foundation for Biomedical Research. **The Use of Animals in Biomedical Research and Testing**. Washington, D.C., Foundation for Biomedical Research, 1988 (8-page booklet).
- Gay, W.I., ed. (1986). **Health Benefits of Animal Research**. Foundation for Biomedical Research, Washington, D.C. 20036.
- Holden, Constance. "Animal Regulations: So Far, So Good." **Science**. November 13, 1987, pp. 880-882.
- McCabe, Katie. "Who Will Live, Who Will Die?" **The Washingtonian**. August 1986.
- McCabe, Katie. "Beyond Cruelty." **The Washingtonian**. February 1990.
- Office of Technology Assessment (1986). **Alternatives to Animal Use in Research, Testing, and Education**. U.S. Congress, OTA-BA-273, U.S. Govt. Printing Office, Washington, D.C. 1989.
- Pringle, Laurence. **The Animal Rights Controversy**. Harcourt Brace Jovanovich, New York 1989.

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